

Detection Limits for ICP-MS Long-lived and Fission-Altered Isotope Ratios In Groundwater At The US Department Of Energy's Hanford Site

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Inductively coupled plasma mass spectrometry (ICP/MS) performance has increased sufficiently in recent years to provide a significantly enhanced ability to quantify many radionuclides of interest in environmental samples. In addition, this new level of ICP/MS performance allows a number of long-lived and stable fission product isotopes to be included in routine analyses. The ability to measure fission product isotope ratios with a precision better than 0.05% (relative standard deviation), provides additional information for interpretation of transport processes in contaminated environments, e.g., the vadose zone near the high level radioactive waste tanks at the US Dept. of Energy's Hanford Site. This enhanced ability also allows us to distinguish between contaminant sources. The expanded suite of isotopes, both radioactive and non-radioactive, that can now be measured provides the capability to distinguish nuclear production contributions from natural background and from fallout.

The success of the ICP-MS measurements is largely due to recent improvements in instrumentation, data collection parameters and simple chemical separations to remove interferences. Several separation procedures for matrix and interference removal were developed for precise and accurate isotopic measurement by ICP/MS. Selection of data collection parameters and sample flow rate for high precision ratio determination was evaluated and results will be presented. Isotopic ratio measurements will be presented for several ground water samples that were analyzed for uranium, molybdenum and ruthenium. Measurements of sample silver isotopic ratios indicate that the ICP-MS precision and accuracy is better than 0.05%. An extension of these measurements to uranium, molybdenum and ruthenium will be discussed.